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UK PATENT APPLICATION

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SHORT TITLE:	DUAL TRANSFORMERS
FORMAL TITLE:	VOICE ACTIVITY MONITORING APPARATUS AND METHODS
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AGENTS FOR THE APPLICANTS

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VOICE ACTIVITY MONITORING APPARATUS AND METHODS

This invention relates to voice activity monitoring apparatus and methods for use with telecommunications apparatus having a local ear-piece and a local microphone.

It is sometimes necessary to determine if a local party or a distant party is talking on a telephone line, or if both parties are talking at the same time or, indeed, if neither party is talking.

It might seem that this could be accomplished by directly monitoring the microphone audio signal and the ear-piece audio signal to detect for voice activity of the local party and the distant party respectively. However, this approach is impractical due to the presence of a low level side-tone; that is, a signal in the ear-piece audio signal originating from the local microphone.

The amount of side-tone present will vary with the type of telecommunications apparatus and may also vary with volume setting in the telephone handset or, in the case of a headset, with the volume setting of a control built into the headset lead. The side-tone will be of unknown phase as well as indeterminate amplitude.

It is an object of the invention to provide a voice activity monitoring apparatus and method which substantially alleviates this problem.

According to one aspect of the invention there is provided a voice activity monitoring apparatus for use with telecommunications apparatus having a local ear-piece and a local microphone, the monitoring apparatus comprising, means for receiving a microphone audio signal and an ear-piece audio signal from the local microphone and the local ear-piece respectively, means for transforming the received microphone audio signal and the received ear-piece audio signal from the time domain to the frequency domain to generate respective transformation signals, and means for monitoring said transformation signals as a function of time to derive voice activity information.

According to another aspect of the invention there is provided a method for monitoring voice activity in telecommunications apparatus having a local ear-piece and a local microphone, the method including the steps of receiving a microphone audio signal and an ear-piece audio signal from the local microphone and the local ear-piece respectively, transforming the received microphone audio signal and the received ear-piece audio signal from the time domain to the frequency domain to generate respective transformation signals, and monitoring said transformation signals as a function of time to derive voice activity information.

A voice activity monitoring apparatus and method according to the invention are now described, by way of example only, with reference to the accompanying drawing which shows a block schematic representation of the apparatus.

Referring to the drawing, a telecommunications apparatus comprises a telephone base unit 1 coupled to the telecommunications network N and a local handset or headset unit 2 including a local ear-piece 3, having a volume control 4, and a local microphone 5. The ear-piece 3 receives an ear-piece audio signal A_E and the microphone 5 generates a microphone audio signal A_m. As already described, the ear-piece audio signal A_E contains a low level side-tone originating in the microphone 5.

A voice activity monitoring unit 10 has respective inputs I_1 and I_2 for receiving the microphone audio signal A_m and the ear-piece audio signal A_E in different channels C_1 and C_2.

The signals in each channel are sampled in respective analogue-to-digital conversion circuits 11 and 12 and the samples in each channel are subjected to a Fast Fourier Transform (FFT) in processor 13 to produce respective transformation signals. In this particular embodiment, the microphone and ear-piece audio signals are both sampled at 8kHz and each FFT is carried out on 128 successive samples. It will be appreciated that other forms of transform could be used.

It has been found that voice activity in the ear-piece and microphone audio signals A_E,A_E can be reliably determined by monitoring the FFT transformation signals generated in the two channels as a function of time.

More specifically, if the amplitudes of the transformation signals in channels C_1 and C_2, measured in one or more corresponding frequency band, are observed to diverge as a function of time (i.e. they change in opposite senses), this is indicative of simultaneous voice activity of the distant party and the local party (i.e. voice signals are simultaneously present in the microphone and ear-piece audio signals A_m,A_E.)

Alternatively, if the two transformation signals are observed to follow or track each other as a function of time (i.e. they change in the same sense), this is indicative of voice activity solely of a local party (i.e. voice signals are present in the microphone audio signal A_m but not the ear-piece audio signal A_E).

By this means it becomes possible to monitor voice activity notwithstanding the presence of a low level side-tone in the ear-piece audio signal A_E.

Of course, the absence of both an ear-piece audio signal and a microphone audio signal indicates that neither party is speaking.

CLAIMS

1. A voice activity monitoring apparatus for use with telecommunications apparatus having a local ear-piece and a local microphone, the monitoring apparatus comprising,

means for receiving a microphone audio signal and an ear-piece audio signal from the local microphone and the local ear-piece respectively,

means for transforming the received microphone audio signal and the received ear-piece audio signal from the time domain to the frequency domain to generate respective transformation signals, and

means for monitoring said transformation signals as a function of time to derive voice activity information.

2. An apparatus according to claim 1 wherein said means for monitoring is arranged to detect for divergence of said transformation signals as a function of time, said divergence being indicative of simultaneous voice activity of a distant party and a local party.

3. An apparatus according to claim 1 or claim 2 wherein said means for monitoring is arranged to detect for tracking of said transformation signals as a function of time, said tracking being indicative of voice activity solely of a local party.

4. An apparatus according to any one of claims 1 to 3 wherein said means for monitoring is arranged to monitor said transformation signals in one or more corresponding frequency band.

5. An apparatus according to any one of claims 1 to 4 wherein said means for transforming subjects the received microphone audio signal and the received ear-piece audio signal to respective Fast Fourier Transforms.

6. A method for monitoring voice activity in telecommunications apparatus having a local ear-piece and a local microphone, the method including the steps of:

receiving a microphone audio signal and an ear-piece audio signal from the local microphone and the local ear-piece respectively,

transforming the received microphone audio signal and the received ear-piece audio signal from the time domain to the frequency domain to generate respective transformation signals, and

monitoring said transformation signals as a function of time to derive voice activity information.

7. A method as claimed in claim 6 wherein said monitoring step includes detecting for divergence of said transformation signals as a function of time, said divergence being indicative of simultaneous voice activity of a distant party and a local party.

8. A method as claimed in claim 6 or claim 7 wherein said monitoring step includes detecting for tracking of said transformation signals as a function of time, said tracking being indicative of voice activity of a local party alone.

9. A method as claimed in any one of claims 6 to 8 wherein said monitoring step includes monitoring said transformation signals in one or more corresponding frequency band.

10. A method as claimed in any one of claims 6 to 9 wherein said transforming step includes subjecting the received microphone audio signal and the received ear-piece audio signal to respective Fast Fourier Transforms.

11. Telecommunications apparatus incorporating a voice activity monitoring apparatus according to any one of claims 1 to 5.

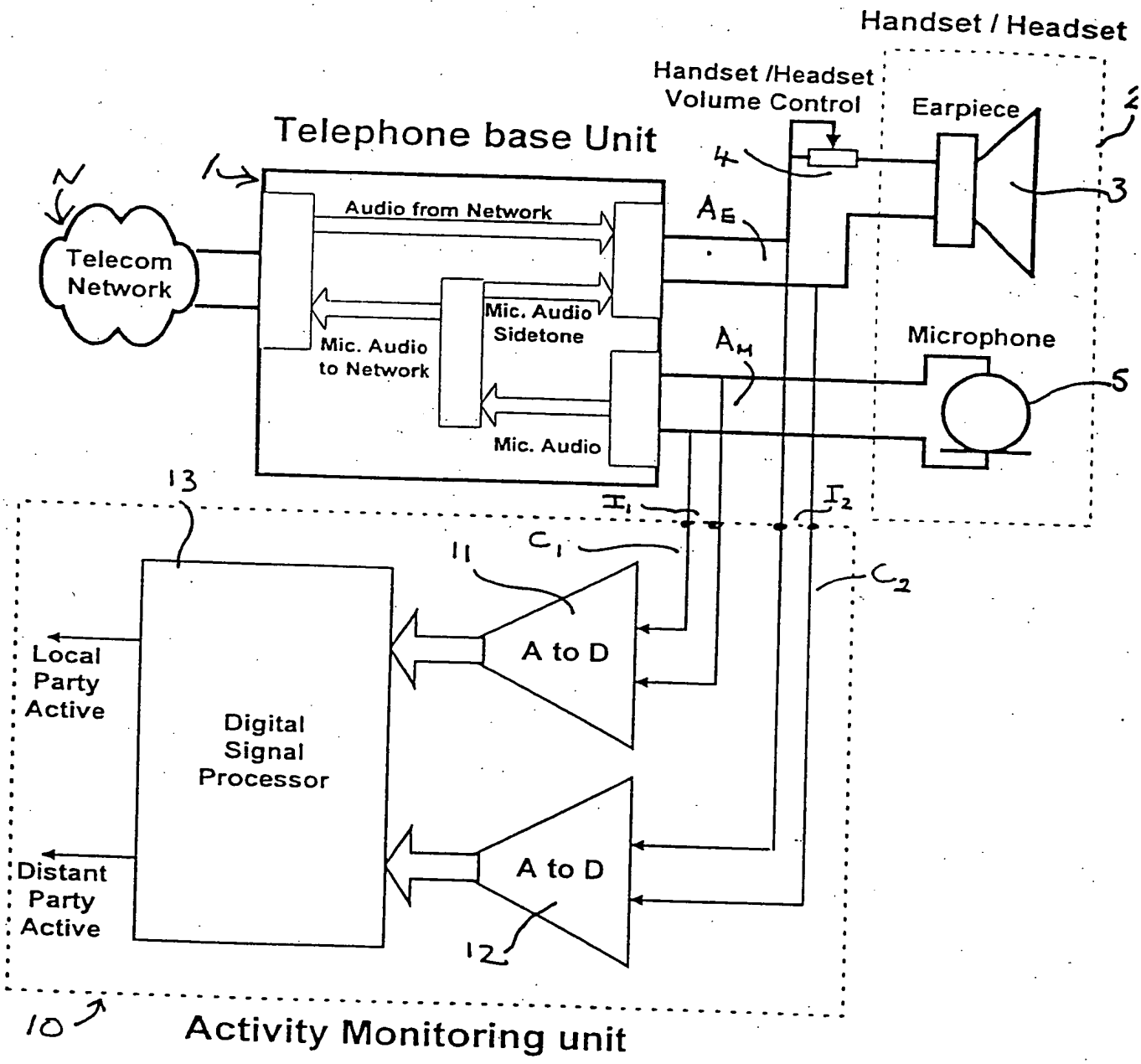
12. A voice activity monitoring apparatus substantially as hereindescribed with reference to the accompanying drawing.

13. A method for monitoring voice activity substantially as hereindescribed.

ABSTRACT

VOICE ACTIVITY MONITORING APPARATUS AND METHODS

A voice activity monitoring apparatus for use with telecommunications apparatus having a local ear-piece and a local microphone receives a microphone audio signal and an ear-piece audio signal from the microphone and ear-piece respectively, transforms the received microphone audio and received ear-piece audio signals from the time domain to the frequency domain to generate respective transformation signals, and monitors the transformation signals as a function of time to derive voice activity information.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Earpiece
Telephone base Unit
Telecom Network
Audio from Network
Mic. Audio Sidetone
Mic. Audio to Network
Mic. Audio
Microphone
Local Party Active
Digital Signal Processor
Distant Party Active
A to D
A to D
Activity Monitoring unit

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